

No. 615,452.

Patented Dec. 6, 1898.

J. L. HASTINGS.
STEAM GENERATOR.

(Application filed June 11, 1897.)

(No Model.)

2 Sheets—Sheet 1.

Fig. 1.

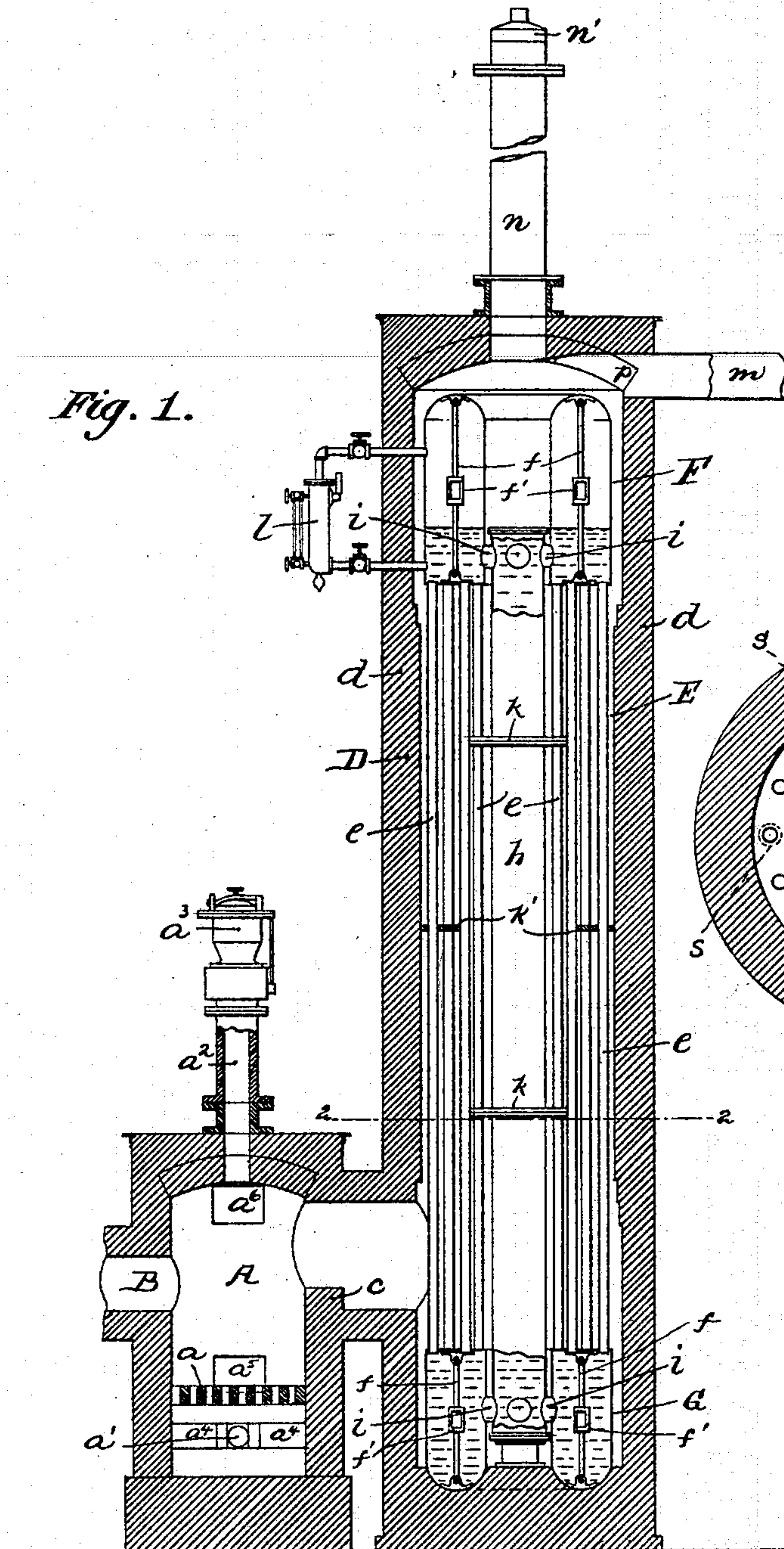
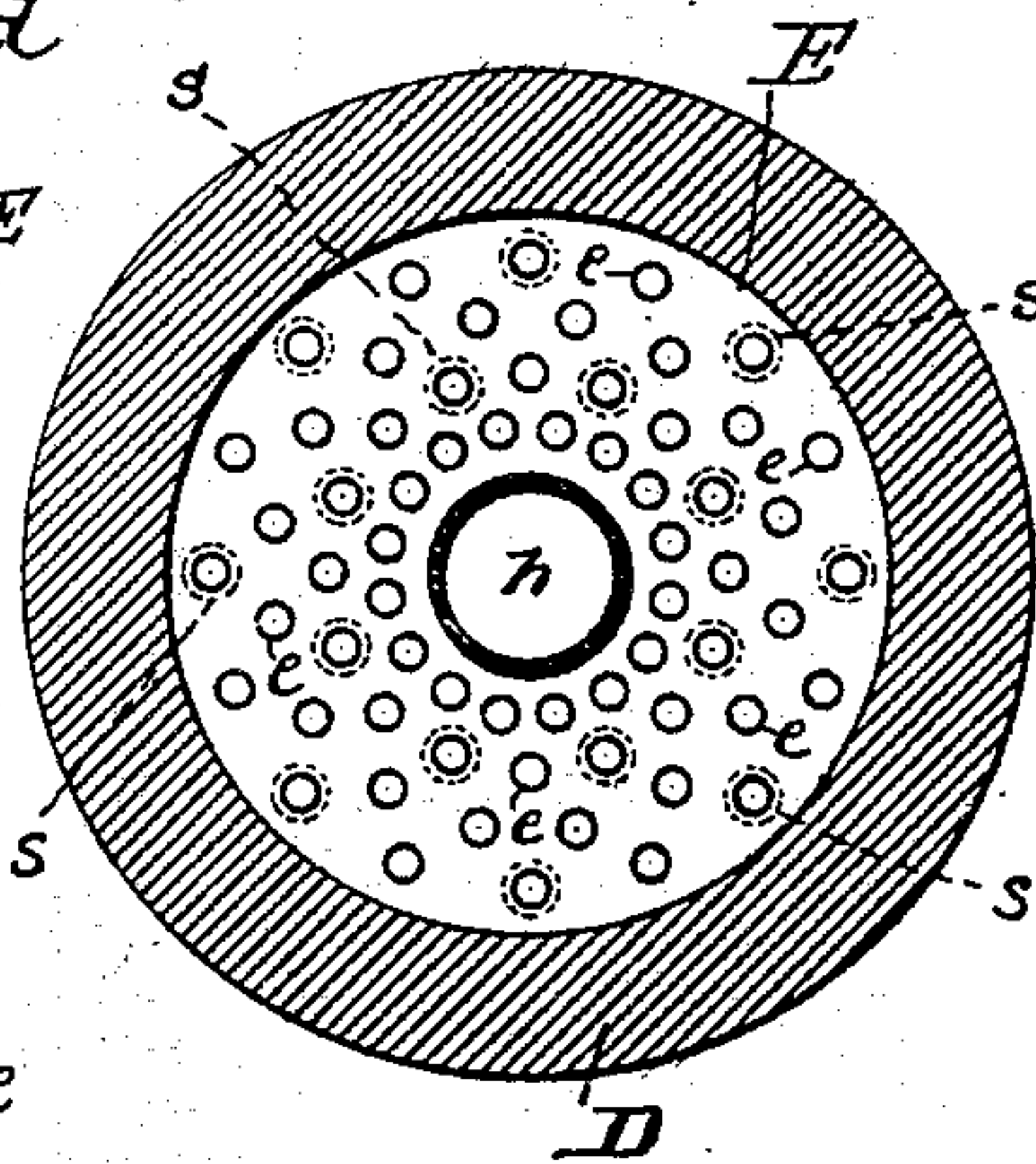


Fig. 2.



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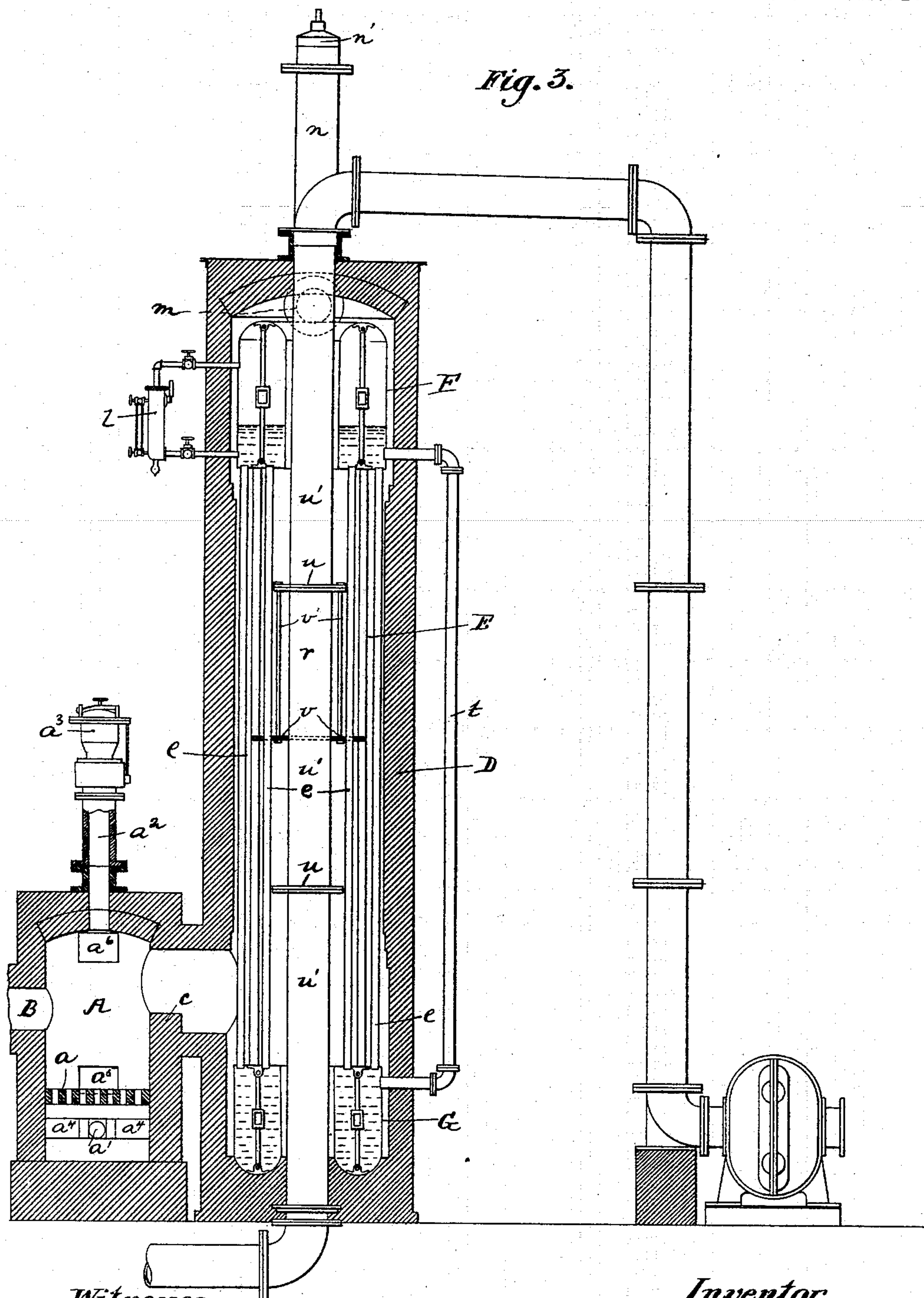
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UNITED STATES PATENT OFFICE.

JAMES L. HASTINGS, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO THE
STANDARD GAS COMPANY OF AMERICA, OF SAME PLACE.

STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 615,452, dated December 6, 1898.

Application filed June 11, 1897. Serial No. 640,340. (No model.)

To all whom it may concern:

Be it known that I, JAMES L. HASTINGS, a resident of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have
5 invented a new and useful Improvement in Steam-Generators; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to steam-generators,
10 its object being to provide a form of steam-generator in which opportunity for absorption of the heat from the flame and heated products is provided while the same are ascending in upward course, and in addition to
15 that provision is made for proper circulation of the water, so as to provide for the rapid ascending and descending currents in the boiler, which gives free opportunity for escape of steam. Another point of advantage
20 aimed at is to provide a form of boiler which has advantages for absorption of the heat from the waste products in gas-manufacturing plants, furnaces, &c., when located close thereto.

25 To these ends my invention consists, generally stated, in a boiler formed of annular upper and lower drums having exposed inner and outer faces and a series of vertical pipes connecting said annular drums with a
30 vertical central pipe extending within the central space formed by the annular drums and within the series of vertical pipes connecting the same, so that all the products of combustion ascending within the generator will pass
35 in contact with the series of tubes connecting the drums or the central pipe above referred to or with the inner or outer walls of the drums and can be deflected into contact with the tubes, so as to cause large absorption of
40 heat by the water in the tubes. The central pipe, when forming part of the generator itself, acts to provide for the downward currents in the regular boiler circulation, so aiding and increasing the circulation thereof.

45 To enable others skilled in the art to employ my invention, I will describe the same more fully, referring to the accompanying drawings, in which—

50 Figure 1 is a vertical central section of the steam-generator and the fire-chamber which is preferably used in connection therewith.

Fig. 2 is a cross-section on the line 2 2, Fig. 1; and Fig. 3 is a longitudinal section illustrating the use of the invention when the central pipe is employed as an air-heating means
55 instead of as the down-circulation pipe of the steam-generator.

Like letters indicate like parts in each of the figures.

As the steam-generator illustrated has ad-
60 vantages when used in connection with the gas-generators or other plants in which the heat of the waste products or escaping gas is utilized for the generation of the steam, I have illustrated it in a plant of that charac-
65 ter, the coal or fire chamber A being located in position to deliver the flame or heated products generated therein into the fire-chamber of the boiler when necessary or being located in the line of escape of the heated prod-
70 ucts or gases from other sources, such heated products or gases entering the fire-chamber A through the port B.

The fire-chamber is constructed with a suitable grate *a*, air-supply entrance *a'*, and feed-
75 ing-chute *a''*, with the feeding-hopper *a'''*, the parts being so constructed as to provide for the feeding of the chamber with the necessary coal or other fuel without permitting escape of the gases from the furnace or other
80 source. The fire-chamber A is therefore preferably operated as an ordinary gas-producer. It has any suitable doors in its side walls to provide for the removal of ashes, &c., such as the doors *a''''* and *a'''''*, and has the air-entrance
85 port *a''''''* in the upper part of the chamber. Located close to this fire-chamber and separated therefrom by the bridge or wall *c* is the boiler-furnace chamber D, which is formed within a large brick-lined casing *d* and extends up
90 for a considerable height, the casing being either separated from or forming part of the casing or inclosure for the fire-chamber A. Within this boiler-chamber is located the boiler E, which is formed of the upper annu-
95 lar drum F and lower annular drum G, with a series of vertical connecting-tubes *e*. The drums are made either of wrought or cast metal, as desired, and for their support may be braced interiorly, as shown, the brace-rods
100 *f* connecting to the top and bottom of the drum and to a stirrup *f'* between them. The

drums are of annular form, as above stated, for the purpose of exposing both their inner and outer surfaces to the heat within the fire-chamber and for the further purpose of obtaining the desired distribution of the boiler tubes or flues *e*, the distribution of which is more clearly shown in Fig. 2, the tubes practically filling the boiler-space except in the center thereof. In this central portion is the central pipe *h*, which is of considerably larger section than the boiler-tubes *e* and when forming part of the boiler system receives the water from the upper drum F and forms the downtake-pipe to the lower drum G. In such case it is connected by large nipples or connecting-pipes *i* with both the upper and the lower drum, connecting with the upper drum below the water-level thereof and with the lower drum about midway of the height thereof, so as to cause a current in the upper part of such lower drum, leaving the lower part quiescent to serve as a mud-drum. It will be seen by this construction that practically all of the space of the boiler-chamber is occupied either by the vertical boiler-tubes or by the central tube. The flame, heated products, or gases will therefore in ascending the boiler travel upwardly in contact with the several tubes thereof and impart their heat thereto. In order to prevent the heated products or gases from following a straight course upwardly around the central pipe *h*, I provide a series of cross baffle-plates *k k'*, filling the space between the central tube and the outer series of tubes, or, if desired, and as more clearly shown in Fig. 1, forming a circuitous course through the boiler-chamber, the cross-plates *k* extending out from the central tube to or within the boiler-tubes *e*, so as to throw the heated products of combustion of gases in among the same, while the plates *k'* extend among the boiler-tubes *e* from the brick lining of the boiler-chamber inwardly toward but not to the central tube *h*. They therefore serve to throw the products of combustion, &c., inwardly toward the central tube, causing a diagonal or cross circulation for the heated products across the outer or boiler tubes and into contact with the central tube. The boiler has the ordinary water-indicator *l*, which communicates with the upper drum F and projects through the casing *d*. It is also provided with one or more steam-outlet pipes *m* for conducting the steam to the point of use. Where the steam-generator is located in connection with a gas-manufacturing plant, I provide two outlets at the upper end of the boiler-chamber B, the outlet *n* serving to permit the escape of the highly-heated products of combustion and forming a stand-pipe, which is controlled by a suitable valve *n'*, while the outlet *p* leads from the upper part of the boiler-chamber to any suitable storage-tank to receive the gases which are to be stored after passing from the gas-generator through the steam-generator.

As so constructed, it is evident that the

steam-generator by providing for the carrying of the flame, heated products, or gases around and among the tubes thereof and into contact with the central pipe and with the inner and outer surfaces of the annular drums provides for the absorption of the greater portion of the heat entering the chamber either from the heated products of the generator-gas or from the gas to be stored, or, when this is not sufficient for raising the desired amount of steam, from the flame and heat generated in the coal chamber or producer A. In their course through the boiler-chamber positive contact of the heated products with the numerous boiler-tubes and the downtake-pipe is assured on account of the cross or baffle plates located at intervals therein. The central pipe also provides for the free and rapid circulation of the water within the boiler upwardly through the tubes *e* and into the upper drum and thence by the nipples or connecting-pipes *i* in slower course downwardly through the said central pipe to the lower annular drum and into the same at a point above the base thereof, so that all sediment can be collected in the lower part of the boiler, while as the boiler-tubes are all vertical there is no liability of scaling or incrustation therein. The large capacity of the central tube *h* provides for the down current, even though located in the center or hottest part of the boiler-chamber, while the numerous boiler-tubes *e* divide the water into such streams as to expose the same to the heated products, &c., and cause the rapid up current and the quick generation of steam therein.

Where, such as in connection with a gas-generating plant, it is desirable to have a supply of heated air, this may be obtained by forming the central pipe into an air-heating pipe, as shown in Fig. 3, such construction, while losing the peculiar advantages of circulation above referred to, having advantages in a gas-generating plant where a large supply of steam may not be required, and it is also desired to heat the incoming air. In such case the construction is substantially the same, differing only in the following points: The central air-pipe *r* passes in a straight course through the top and bottom walls of the boiler-chamber and within, but is not connected with, either drum, the air being forced by a suitable blower through this pipe and thence to the point where the heated air is to be used. It will be seen that so far as the method of applying the heat is concerned the construction is practically the same; but in order to provide for down circulation it is necessary to employ either enlarged pipes among the smaller boiler-tubes, as indicated in dotted lines at *s* in Fig. 2, or to accomplish such circulation by a pipe extending outside of the boiler-chamber and connecting the upper and lower drum, as shown at *t*. As this air-pipe is preferably formed of sections of flanged cast-iron pipe, the flanges *u* of the sections *u'*

of pipe composing the entire vertical pipe *r* may form the cross or baffle plates, which can be arranged differently, if desired. For example, where these flanges *u* form such baffle-plates, in order to locate a like plate between them to prevent the current from hugging or passing up around the central pipe, the ring plate *v* may be hung from the upper flange *u* midway between it and the lower such flange by suitable tie-rods *v'*.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. A steam-generator formed of a boiler or generator chamber, upper and lower annular drums having exposed inner and outer faces and vertical boiler-tubes connecting the same, and a central vertical pipe extending between the drums and within the annular spaces of the drums, substantially as set forth.

2. A steam-generator formed of a boiler or generator chamber, upper and lower annular drums having exposed inner and outer faces and vertical boiler-tubes connecting the same, and a central vertical pipe extending between the annular drums and within the annular spaces of said drums, and cross or baffle plates for directing the current in the boiler-chamber, substantially as set forth.

3. A steam-generator formed of a boiler or generator chamber, upper and lower annular drums and vertical boiler-tubes connecting the same, and a central vertical pipe extend-

ing between the annular drums and within the annular spaces of said drums, and cross or baffle plates for directing the current in the boiler-chamber, said baffle-plates contacting alternately with the central pipe and the wall of the boiler-chamber, substantially as set forth.

4. A steam-generator formed of a vertical boiler-chamber having upper and lower annular drums having exposed inner and outer faces and vertical boiler-tubes connecting the same, and a central vertical pipe extending between the drums and within the annular spaces thereof and nipples connecting the vertical pipe with the annular drums, substantially as set forth.

5. The combination of a steam-generator having a boiler-chamber and having therein upper and lower drums and tubes connecting the same, and a coal or fire chamber at one side of and communicating with the boiler-chamber and having opposite to the port communicating with the boiler-chamber and above the fire-pot an entrance-passage for heated gases from other sources, substantially as and for the purposes set forth.

In testimony whereof I, the said JAMES L. HASTINGS, have hereunto set my hand.

JAMES L. HASTINGS.

Witnesses:

JAMES I. KAY,
ROBERT C. TOTTEN.